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A Revision of the *Delias aroae-cuningputi* Complex (Lepidoptera, Pieridae)

1. The *D. aroae* Group

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Abstract The montane *Delias* of the island of New Guinea form a highly variable group which includes many species-group taxa of uncertain status. We note the problems associated with the classification of the group and the necessity of establishing the identity of all named taxa to provide a framework within which new taxa may be placed. We discuss the taxonomic value of various characters which have been used by previous authors. We define the *Delias aroae-cuningputi* complex and the *D. aroae* group and describe and figure a total of 12 species-group taxa of the *aroae* group. Where possible we illustrate type specimens. We divide the group into four parts including two species-complexes within which we regard most taxa as being of uncertain status, but formally we treat them in binomial format in order to emphasise their individuality. We describe two new species, *D. flavissima* and *D. subapicalis*.

Introduction

TALBOT's classic revision of the pierine genus *Delias* HÜBNER, 1819 was completed in 1937. Since World War II the lower classification of *Delias* from the highlands of Papua New Guinea and Irian Jaya, where over 170 of the 480 species-group taxa in the genus occur, has been extended by ROEPKE (1955), SANFORD and BENNETT (1955), BENNETT (1956), NIEUWEHUIS & HOWARTH (1969), SCHRÖDER (1977), SIBATANI & NISHIZAWA (1982), and ARORA (1983). In addition, colour illustrations of many representative taxa by D'ABRERA (1971, 1978) have greatly facilitated identification. However, despite these contributions, there remain several 'difficult' groups in which the status of many species-group taxa (*i.e.* species and subspecies) is not well understood. The scheme of classification as proposed by TALBOT (1928-1937) was often unbalanced, with far greater variation between conspecific subspecies than between certain races of different species. In particular, *D. pheres* JORDAN, 1911 included several quite divergent elements, whereas, among other examples, *D. aroae aroae* (RIBBE), 1900 and *D. pheres pheres* are sufficiently close to be considered conspecific. As a consequence several distinctive forms remain obscure and inadequately defined, and TALBOT's (1928-1937) keys to species level are often unworkable. ROEPKE (1955) added to the

confusion by lumping into single species several pairs of allopatric taxa which TALBOT (1929–1937) had recognised as separate species. These include *D. pheres* JORDAN, 1911, and *kenricki* TALBOT, 1937; *D. microsticha* ROTHCHILD, 1904 and *flavopicta* JORDAN, 1911. *D. sagessa* FRUHSTORFER, 1910 and *anjae* SCHRÖDER, 1977 may also fall into this category.

Because of geographic and seasonal discontinuities in collecting and the rarity of many taxa in montane New Guinea, the relationship of many taxa remains unclear. However, the situation would be improved if the identity of all known named taxa were first firmly established, while the relationships between them were left open to question until such time as more adequate data are available.

Working on *Phyciodes* HÜBNER, 1819 and related genera (Nymphalidae), HIGGINS (1981) expressed his view on a similar problem as follows: "Often the material has been collected from a single locality, perhaps during a single visit, and so for many species it is not possible to define distribution frontiers. This leads to taxonomic difficulties as often there is little information about seasonal variation or possible distributional overlap or clinal series. In the absence of this information it is only by guessing that the status, local or individual form, seasonal modification or geographical subspecies, can be decided, when specimens with slightly different phenotypical characters are reported flying in widely separated localities. In such cases, where the differing characters are constant and easily recognisable, the butterflies are treated here as distinct species, in order to emphasize their individuality." In keeping with this view, HIGGINS (1981) appended his work with a review of the classification of the Melitaeinae, in which, for example, the genus *Didymaeformia* VERITY, 1950 contained three groups of species encompassing 30 species and no subspecies.

For similar reasons we feel that in treating the *Delias* taxa of montane New Guinea, it is most constructive to give some of the ill-defined but distinguishable, named, local populations binomial designations. This does not imply that we believe that taxa so designated necessarily represent discrete species. Rather we feel that a trinomial system would impose an artificial structure on our classification which would misrepresent our knowledge of the situation. As we use it, a binomial classification is essentially a system of cataloguing and is non-committal regarding the status of certain forms. We have retained all valid names existing in the literature, and related forms, mostly of uncertain status, are collectively termed a "species-complex". Names we consider to be of doubtful value are enclosed in inverted commas.

In the present series we treat two groups of taxa occurring in the highlands of the island of New Guinea. These we define as the *aroae* group and the *cuningputi* group. Both of these groups have been included in Group 5 of TALBOT (1929), later termed the *Geraldina* group (Talbot 1937). As our groupings represent a lower level of classification than those of TALBOT (1929, 1937) it has not been necessary to examine closely the validity of his groups.

Recently two distinctive taxa related to *D. aroae* but unplaceable in the current classification scheme have been discovered in the Western Highlands of Papua New Guinea. In order to describe them as new to science, it was mandatory to distinguish them from known allied taxa. However, since such a framework for comparison has

so far remained ill-defined, it was necessary to define and undertake a full revision of the *aroae* group. As a natural extension of the work, we also consider the allied *cuningputi* group which will be dealt with in a subsequent paper.

Throughout the text the following abbreviations are used to indicate sources of material: ANIC, Australian National Insect Collection, Canberra; BMNH, British Museum (Natural History), London; IFTA, Insect Farming and Trading Agency, Bulolo, Papua New Guinea; RL, Rijksmuseum van Natuurlijke Historie, Leiden; AO, A. G. ORR collection; AS, A. SIBATANI collection; PS, P. F. SAWYER collection; d, dorsal surface or upperside of wings; v, ventral surface or underside of wings.

Notes on the Characters

In his extensive revision of the genus, TALBOT (1928–1937) figured for most species the uncus, valva, and androconium. He treated these characters as being of primary importance, both in his division of the genus into 20 major groups and in distinguishing between otherwise very similar species. Moreover, in recent years it has become almost standard practice to describe and figure male genitalia when erecting new taxa at various levels; hence we feel we should explain our reasons for not taking these characters into account.

We dissected male genitalia of some 50 specimens belonging to 10 lower taxa of the groups under consideration as well as many other *Delias* species. The variation observed in the shape of the uncus and the valva was often as great within a conspecific series collected from the same locality and on the same day as the variation within an entire group of species. In some extreme cases there was marked asymmetry in the shape of the left and right valvae in the one specimen. While the taxonomic value of male genitalia in other butterfly groups is not disputed it is clear from our observations that they do not afford useful characters at the species level in the *Delias* generally and particularly within the groups dealt with in this paper. We did not examine female genitalia, but TALBOT's (1929) figures strongly suggest that this would not have been fruitful. ROEPKE (1955) also refrained from considering genitalia for essentially similar reasons.

We examined the androconia of 13 lower taxa under the scanning electron microscope and found them to be generally uniform in structure. Although at magnifications of between 700 and 1000 there was little observable variation in gross morphology within a taxon, the variation between closely allied taxa was not sufficient to allow separation on this basis. Examination of the ultrastructure of the scales at higher magnifications revealed no discernible variation either within a taxon or between taxa.

Ultraviolet reflectance patterns of the uppersides have provided useful characters for some pierine taxa (FERRIS, 1973). Accordingly, near-ultraviolet photographs of most lower taxa dealt with were taken, using the method of BOWDEN and KAY (1979). We could not however detect any distinctive patterns, hence we have not taken these into consideration.

We have attempted to put wing shape on a quantitative basis by measuring the

apical angle. This we defined as the angle between a tangent to the costa at its midpoint and a line parallel to the termen. The measurement was obtained from enlarged photographs rather than cabinet specimens. Although it is recognised that there is a significant error in this measurement ($\pm 1.5^\circ$), the range of variation between taxa is considerably greater. With certain exceptions the variation within a single taxon is too small to be measured, given the error factor. The error estimate of $\pm 1.5^\circ$ was established by measuring independently the same specimens ten times and comparing the maximum and minimum values obtained. Otherwise specimens were measured only once.

Delias aroae-cuningputi Complex

The complex includes two groups of obvious affinity which may be readily separated from related species; hence we treat them together as a natural subdivision of TALBOT's (1928) Group 5. Nevertheless, our delimitation of the complex is somewhat arbitrary, since we have not based our grouping of allied species on comprehensive studies of all relevant allied species, but have simply included species which we considered were very similar to *Delias aroae* (RIBBE) and *D. cuningputi* (RIBBE), 1900. The exclusion of all other taxa from the present revision is due more to convenience than to any detailed taxonomic reasoning. All species included are endemic to montane areas of the island of New Guinea, and the following points serve to distinguish them from related species included in Groups 4 (*Stresemanni* group), 5 (*Geraldina* group), and 6 (*Eichhorni* group) of TALBOT (1928–1937), most of which occur on the same island.

1. Underside lacks any red markings.
2. Underside hindwing grey to dark grey-brown with yellow spots and a median white band containing yellow spots extending from costa to at least beyond M_1 .
3. When this median band is bordered by a yellow streak at costa, the yellow streak is not confined within the width of the median band.
4. When the median white band extends posterior to M_2 , its distal margin is crenulate, not smooth (except in female *D. endela* JORDAN, 1930).
5. Underside hindwing submarginal row of spots entirely yellow rather than white with a yellow streak running along the mid-line of the cellule.

Of these points, 1 excludes, besides many other species of *Delias*, *lecerfi* JOICEY & TALBOT, 1922 of Group 4 and *sagessa* FRUHSTORFER, 1910, *thompsoni* JOICEY & TALBOT, 1916 and *microsticha* ROTHCHILD, 1904 of Group 5; 2 excludes most species of Group 4 as well as *flavopicta*, *itamputi* (RIBBE), 1900, *heroni* KENRICK, 1909, *rileyi* JOICEY & TALBOT, 1922, *albo-oculata* JOICEY & NOAKES, 1915, *nigropunctata* JOICEY & NOAKES, 1915 and *hypomelas* ROTHCHILD & JORDAN, 1907 of group 5; 3 excludes ♀-form *albifascia* of *flavopicta* JORDAN, 1911 of Group 5 and *schmassmanni* JOICEY & TALBOT, 1923 of Group 4 from Buru; 4 excludes *geraldina* GROSE-SMITH, 1894; and 5 excludes *imitator* KENRICK, 1911 of Group 5 and all the species of Group 6 including *eichhorni* ROTHCHILD, 1904 and *gilliardi* SANFORD & BENNETT, 1955.

Key to Males

1. Underside hindwing submarginal yellow/orange spots broad and

- roughly triangular, at least some of them reaching termen; hindwings usually not strongly scalloped or if so then both wings dusky brown above 2
- Underside hindwing submarginal yellow/orange spots reduced to a thin bar, spot or crescent parallel to termen with thin lines radiating from their midpoints but seldom reaching termen; hindwings usually strongly scalloped (*cuningputi* group)13
2. Upperside both wings ground colour white or whitish 4
- Upperside both wings ground colour not as above 3
3. Upperside both wings ground colour lemon yellow*flavissima*
- Upperside both wings entirely dusky brown*kenricki*
4. Underside forewing discal area white with at least some white in discal cell 5
- Underside forewing discal area yellow/orange or predominantly black; no white in discal cell11
5. Large (forewing generally 26–27 mm); upperside forewing margin of black area straight and conspicuously angled at M_2 ; subapical white spots always occurring in R_4-R_5 and in other spaces*subapicalis*
- Smaller (forewing generally <25 mm); upperside forewing margin of black area variable but not straight and without conspicuous angle at M_2 ; subapical spots very rare and never in R_4-R_5 6
6. Underside forewing all white area not reaching anterior margin 7
- Underside forewing cell white area reaching anterior margin 8
7. Underside forewing cell predominantly black; white area along posterior margin just reaching cell midline (taken from cell base to centre of discoidals)*pheres*
- Underside forewing cell half black; white area along posterior margin extending anteriorly beyond cell midline*approximata*
8. Underside hindwing white median band and included yellow spots not reaching dorsum*angiensis*
- Underside hindwing white median band and included yellow spots reaching dorsum 9
9. Upperside forewing apical black area narrow never meeting cell end; margin smoothly curved; underside forewing usually with white area distad of cell and separated from discal cell white by black triangular area at cell end*yabensis*
- Upperside forewing apical black area broader either meeting or not meeting cell end, margin usually irregularly curved; underside forewing never with white area distad of cell end10
10. Underside forewing cell half black; occurring in central east Irian Jaya*balimensis*
- Underside forewing cell white area dominating; black area restricted to proximal end and anterior margin of cell; occurring in Papua New Guinea (certain specimens may be inseparable from *approximata* or

- balimensis*) *aroae*
11. Underside forewing discal area predominantly black with small whitish patch on dorsum *endela*
 — Underside forewing discal area yellow 12
12. Upperside hindwing black margin not continuous towards tornus; underside forewing yellow area not extending further than midline of discal cell *hyperapproximata*
 — Upperside hindwing black margin continuous to tornus; underside forewing yellow area extending beyond midline of discal cell, often reaching its anterior margin *angabungana*
13. To be published later (Part 2)

Key to Females

This is necessarily incomplete because females of four taxa are still unknown.

1. Underside hindwing submarginal yellow/orange spots broad and roughly triangular, at least some of them reaching termen; hindwings usually not strongly scalloped or if so then both wings mostly dusky brown above 2
 — Underside hindwing yellow/orange spots reduced to a thin bar, spot or crescent parallel to termen with thin lines radiating from their mid-points but seldom reaching termen; hindwings usually strongly scalloped (*cuningputi* group) 10
2. Upperside forewing whitish 3
 — Upperside forewing predominantly dusky brown *kenricki*
3. Underside forewing light area yellow, often pale 4
 — Underside forewing light area white 5
4. Underside hindwing proximal border of submarginal dark area crenulate *hyperapproximata*
 — Underside hindwing proximal border of submarginal dark area smooth *endela*
5. Underside forewing cell white area not reaching its anterior margin 6
 — Underside forewing cell white area reaching its anterior margin 7
6. Underside forewing cell predominantly black, anterior margin of white area not reaching cell midline *pheres*
 — Underside forewing cell half black; anterior margin of white area extending beyond cell midline *approximata*
7. Upperside hindwing black margin tapering and breaking up towards tornus (form 1) 8
 — Upperside hindwing black margin wide and uniform with smooth proximal border (form 2) 9
8. Underside hindwing median band not reaching dorsum *angiensis*
 — Underside hindwing median band reaching dorsum 9
9. Upperside forewing apical black area not reaching cell; black bar at

- distal end of cell; occurring in Irian Jaya*yabensis*
 — Upperside forewing apical black area reaching cell; occurring in
 Papua New Guinea*aroae*
 10. To be published later (Part 2)

D. aroae Group

This group may be distinguished from the *cuningputi* group as indicated in the preceding keys. In addition the uncus, figured in TALBOT (1929) plate 2, figs 35–39, although variable, is much shorter and broader in this group than in the *cuningputi* group. (This observation is based on dissections of most taxa of the *aroae* group and *D. cuningputi*, and on TALBOT's figures.) The group falls into four main subdivisions: *aroae* species-complex, *hyperapproximata* species-complex, *flavissima* sp. nov. and *kenricki* TALBOT.

Delias aroae Species-Complex

Included taxa: *D. aroae* (RIBBE), 1900

“*D. balimensis* ROEPKE, 1955”

D. yabensis JOICEY & TALBOT, 1922

D. angiensis TALBOT, 1928

D. pheres JORDAN, 1911

D. approximata JOICEY & TALBOT, 1922

D. subapicalis sp. nov.

This species-complex includes some taxa which are difficult to assign to particular species because what can be regarded as two sympatric species (*D. yabensis* and *D. approximata*) in central Irian Jaya may both be continuous to an apparently single but variable species (*D. aroae*) in Papua New Guinea. With the exception of *D. subapicalis*, which exhibits broad sympatry with *D. aroae*, we could not detect any clear-cut signs of speciation, and since the remaining taxa appear to be mostly allopatric we cannot be certain whether the complex represents two or upwards of four species.

Delias aroae (RIBBE), 1900

(Figs 1, 17–21)

Pieris aroae RIBBE, 1900: 346 ♂.

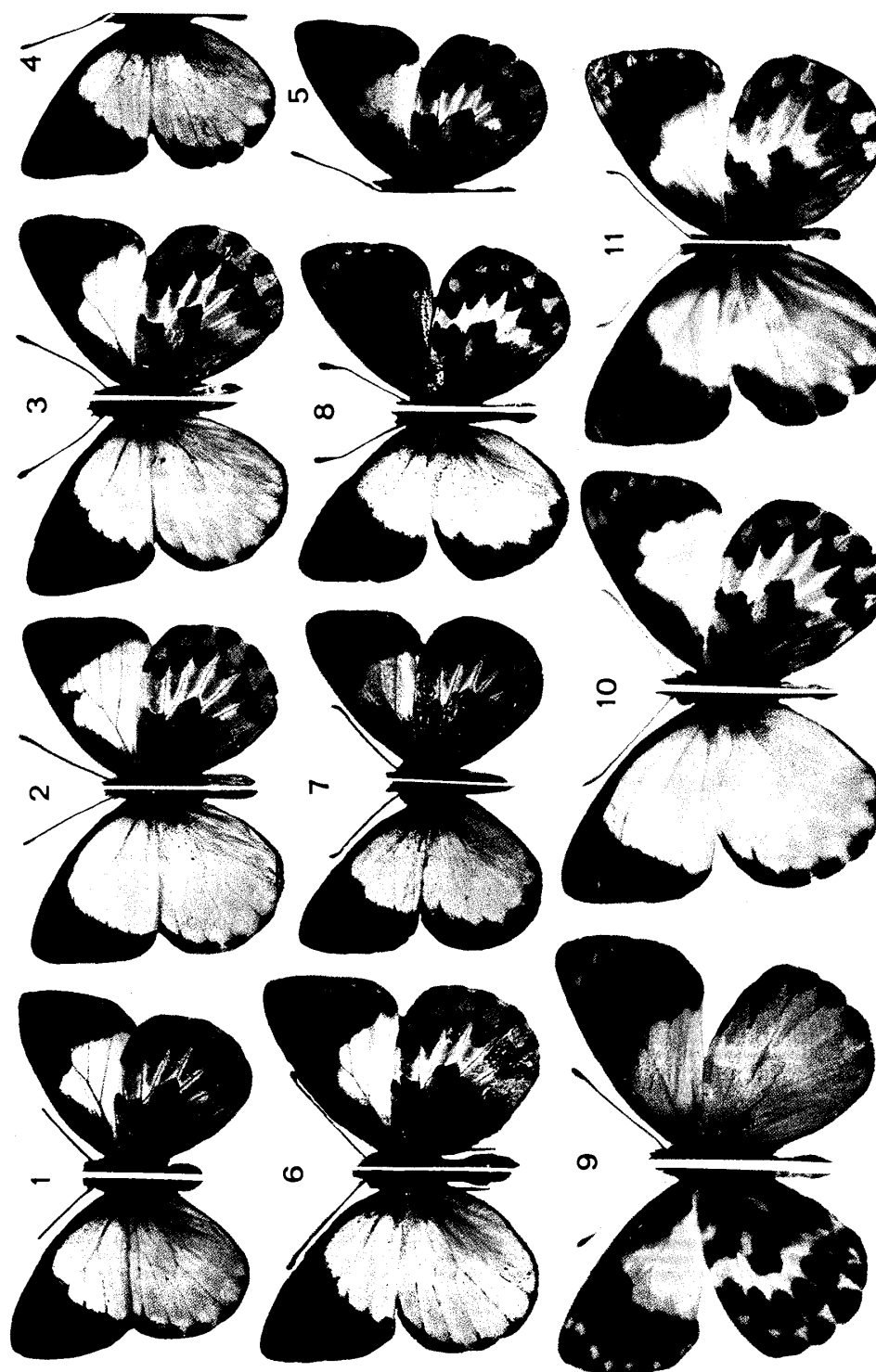
Delias aroae RIBBE: GROSE-SMITH & KIRBY, 1901: 33, pl. *Delias* 9, figs 4, 5 ♂ dv; ROTHSCHILD, 1904: 314, pl. 2, fig. 4 ♀ v; FRUHSTORFER, 1909–1911: 120.

Delias aroae aroae RIBBE: TALBOT, 1929: 190, 192–193, pl. 2, fig. 38 uncus; TALBOT, 1932: 84.

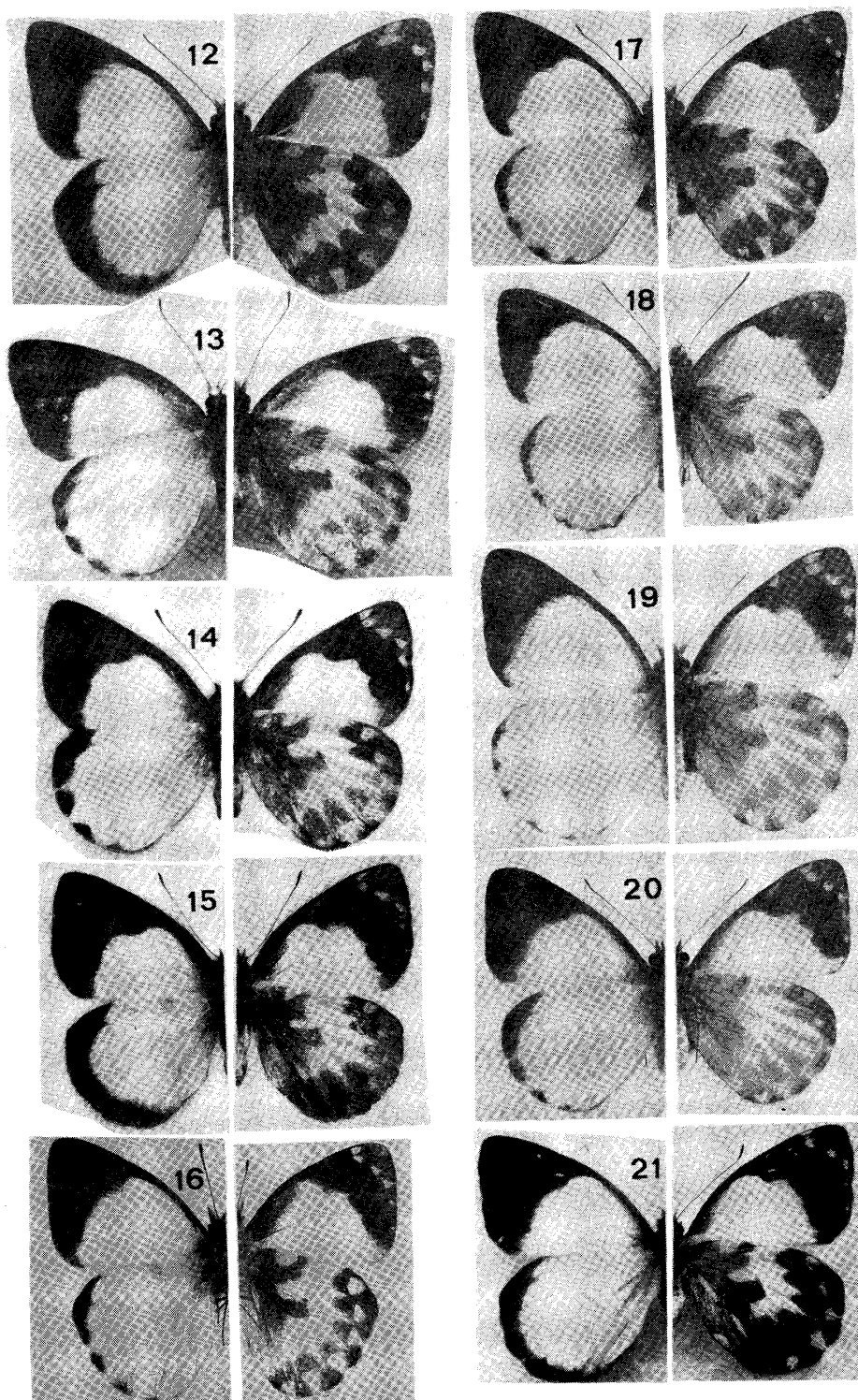
Delias aroa aroa [sic] RIBBE: ROEPKE, 1955: 204; D'ABRERA, 1971, 1978: 133.

Type — *Pieris aroae* RIBBE, *lectotype* (here designated) ♂, PAPUA NEW GUINEA: Central Province — labelled “Aroa R., Brit. N. G. (WEISKE)” in the ROTHSCHILD collection housed in the British Museum (Natural History).

Other material examined — PAPUA NEW GUINEA: Central Province — Tapini



Figs 1–11. *Delias* spp. 1: *Delias aroae* (RIBBE) ♂ (type 1b), Ougarra 1903 BMNH. 2: *D. yabensis* JOICEY & TALBOT ♂, lectotype. 3: *D. approximata* JOICEY & TALBOT ♂, lectotype. 4: *D. hyperapproximata* ROTHCHILD ♂, holotype, upperside. 5: Ditto, underside. 6: *D. pheres* JORDAN ♂, lectotype. 7: *D. angabungana* TALBOT ♂, holotype. 8: *D. endela* JORDAN ♂, lectotype. 9: *D. flavissima* nov. ♂, holotype, right wings. 10: *D. subapicalis* nov. ♂, holotype. 11: *D. hyperapproximata* ROTHCHILD ♀, paratype BMNH. Figures are all in approximately natural size. Unless otherwise specified, left wings are shown, upperside on the left, underside on the right.



Figs 12–16. *Delias* spp. 12: *Delias angabungana* TALBOT ♂, Tapini-Bome, ANIC. 13: *D. pheres* JORDAN ♀, no data BMNH. 14: *D. approximata* ♀ f. 1, paralectotype, Menoo Valley BMNH. 15: *D. approximata* ♀ f. 2 (*rectimargo*), Mt. Kunupi BMNH. 16: *D. balimensis* ROEPKE ♂-holotype. Figs. 17–21. *Delisa aroae* (RIBBE). 17: ♂ (type 1a), Wau area ANIC. 18: ♂ (type 2b), Garaina AS. 19: ♂ (type 2a), Nondugl ANIC. 20: ♀ f. 1, Nondugl ANIC. 21: ♀ f. 2, Owgarra BMNH. Figures are all in approximately natural size. Left wings are shown, upperside on the left, underside on the right.

area, 4♂♂ Bome AS, 2♂♂ Erume 2200 m 10 km N of Tapini 6. vii. 1974 AO — Waitape area, 1♂ Fane (8.32S 147.05E) 1600 m 3. vii. 1948 DE VERTEUIL BMNH, 3♂♂ Kosipe AS, 1♂ Waitape AO; Aroa River, Owgarra (north of head of Aroa R.) 1♂ viii. 1903 A. S. MEEK (*FRUHSTOFER*) 12♂♂ before 1907 MEEK/before 1910 (*GROSE-SMITH*) BMNH, 2♂♂ RL; no locality, 1♂ 16. viii. 1971 AS; Northern Province — Mambare River, 1♂ Biagi 8.30S 147.30E 1800 m i.–iv. 1906 MEEK (*JOICEY*) 1♂ Biagi Meek (*ADAMS*) 1♂ (*GROSE-SMITH/JOICEY*) BMNH; Morobe Province — Mumeng area, 2♂♂ 1♀ Sambio 1500 m ii., vi. 1981, viii. 1982 IFTA/AS — Wau area, 11♂♂ Kodama Range/Mt. Kaindi 1600 m 16. xi. 1951–14. ii. 1952 BRANDT ANIC, 5♂♂ Kunai Ck 1200 m 3♂♂ Nami Ck 1800 m 4♂♂ Mt. Kaindi 2100 m xii. 1973–i. 1974 AO, 2♂♂ Nami Ck 1700 m 18. x. 1968 COLMAN 1♂ Mt. Kaindi Blue Points 25. xii. 1970 SIBATANI 5♂♂ 1800 m iii. 1973 OHLMUS AS, 1♂ Edie Ck 2♂♂ Kaindi BMNH — Garaina 3♂♂ 3. i. 1971 SIBATANI 1♂ HUTTON AS; Western Highlands — Nondugl 9♂♂ 3♀♀ 1900 m 1. x.–12. xi. 1950 BRANDT ANIC; West Sepik Province — Telefomin 8♂♂ 1700 m 8. vi. 1959 BRANDT ANIC; no data, 1♂ before 1920 (*BREVANT/JOICEY*) 7♀♀ (*BETHUNE-BAKER/JOICEY*) BMNH.

RIBBE (1900: 308, 346) based his description of *Pieris cuningputi* and *Pieris aroae* on unspecified numbers of males (syntypes) from the Aroa River, 7000 feet (2100 m). These were possibly collected by WEISKE, as *Papilio weiskei* (= *Graphium weiskei*) was also described in the same paper. According to R. KRAUSE of Staatliches Museum für Tierkunde, Dresden, RIBBE's specimens except for Lycaenidae were largely sold, often through STAUDINGER and BANG-HAAS (HORN & KAHL, 1936: 3, 224). TALBOT (1929: 187, 193) stated that types of *Delias cuningputi* and a type of *D. aroae* were held in Tring Museum under Walter ROTHSCILD. Today, males (one each of both species) with similar label data of "Aroa R., Brit. N. G. (*WEISKE*)" are located in the British Museum (Natural History), but a blue 'Original' label of the usual German type, indicating the specimen to be a syntype, is attached to the *cuningputi* specimen only. Hence there is a possibility that the *aroae* specimen is not the syntype. In that case the designation of lectotype in this paper simply becomes invalid. Today the Aroa River can be located northwest of the Brown River near Port Moresby. The upper limits of its catchment area reach an altitude of 2500 m south of Waitape. This could have been the locality of the lectotype. The Mambare River rises in the Owen Stanley (3000–4000m) and Ajule Kajale (2000 m) Ranges in the vicinity of Kokoda, and flows into the Huon Gulf at its south-eastern limit. Although we were unable to locate the exact position of Biagi, it seems to be not far from Kokoda.

In the following we give a rather detailed description of this taxon because of its frequent occurrence in collections, and also to establish a standard to which other taxa may be referred later. We have not illustrated the lectotype, but a good figure of this specimen is to be found in GROSE-SMITH & KIRBY (1901).

Male — Forewing 21.5–27 mm; apical angle very variable; type a approximately 52°, type b approximately 57°. Upperside: white; forewing with black apical area of variable extent; type 1 (Fig. 17) black area meeting end of discal cell; type 2 (Fig. 18) inner margin black area 1–2 mm distad from end of discal cell, occasionally with row of faint subapical spots; type 1 specimens commonly with apical angle more acute

than type 2-specimens; intergrades occur in both characters; hindwing with black border 1–2 mm wide, broken into discrete spots towards tornus; width of border not correlated with forewing type. Underside: forewing basal two-thirds white with variable black area in basal part of discal cell; apical black area curving in sharply to meet cell end; 3 subapical and 3 small submarginal yellow spots, the latter often reduced; hindwing dark brown with variable yellow suffusion; 1 humeral, 3 subbasal, 6 median and 6 submarginal yellow spots; median white crenulate band 3–5 mm wide, reaching dorsum, margins often diffuse.

Female — Forewing 22–26 mm. Similar to male but black area on upperside of both wings more extensive; slightly yellowish along margin of black area; margin on forewing angular in middle of M_3 – CuA_1 . Hindwing dimorphic: f. 1 (Fig. 20) — upperside, marginal black border as in male but slightly broader; underside, median crenulate band reaching dorsum even if broken — f. 2 (Fig. 21) — upperside, marginal border uniformly 3 mm wide continuing unbroken to dorsum; underside, median band terminating on CuA_2 thus not reaching dorsum.

Distribution — Papua New Guinea, between 1200 m and 2600 m from Telefomin in the highlands of West Sepik to almost the eastern end of the Owen Stanley Range. It is not known from adjacent islands. According to T. FENNER and M. PARSONS the collections of Papua New Guinea Government at Konedobu and IFTA contain specimens from both sides of the Owen Stanley Range and Mt Wilhelm as well as nearby valleys: Feramin (West Sepik), Mandandurugl near Kerowagi and Kundiawa (Chimbu), Karamuki (Madang), Goroka, Aiyura and Okapa (Eastern Highlands), Komako near Kaintiba (Gulf), Naniwe Mission near Menyamya, Bulolo (Morobe) and Mt Suckling (1700–2600 m, at the border of Central, Northern and Milne Bay Provinces).

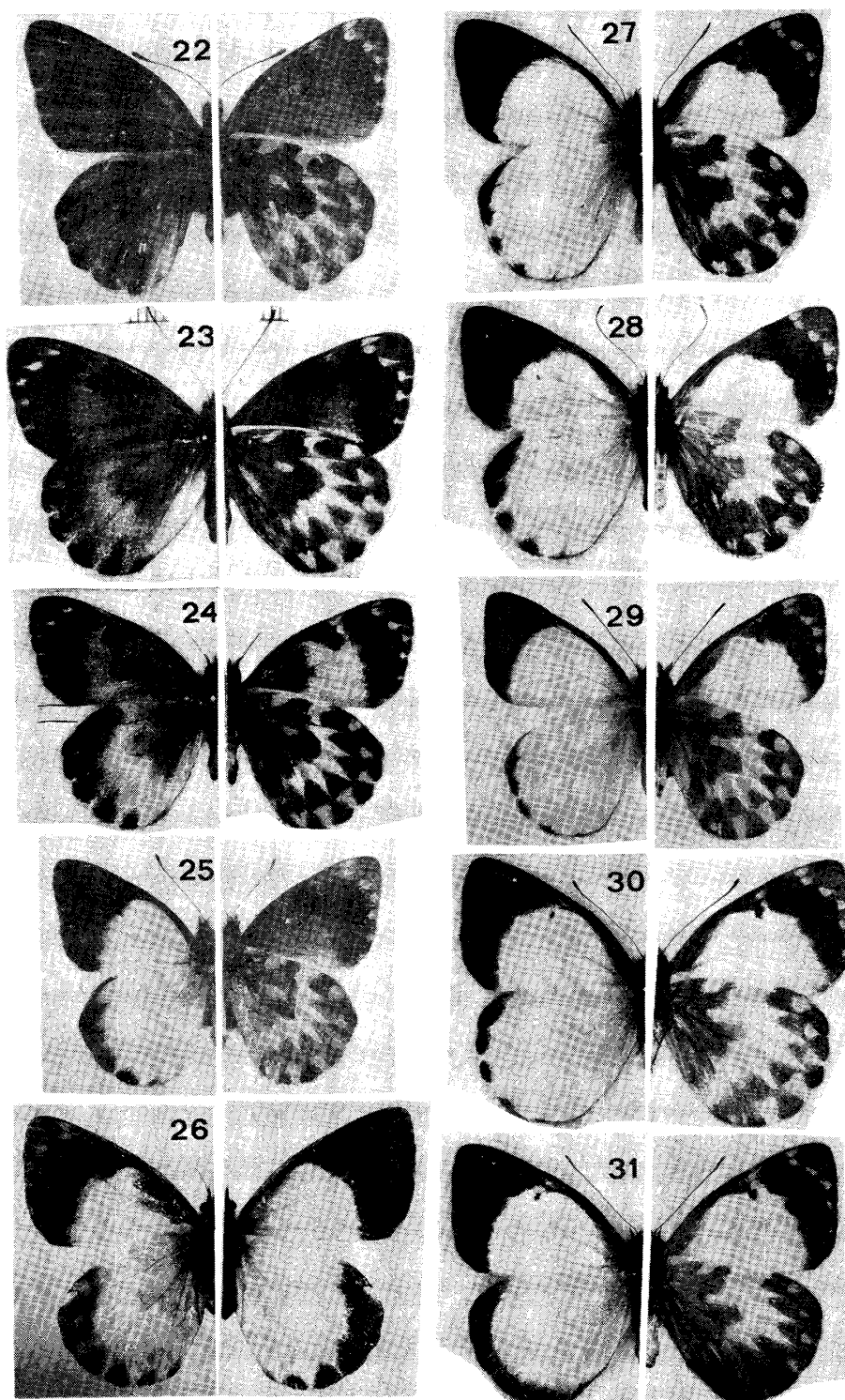
“*Delias balimensis* ROEPKE”, 1955, *stat. nov.*

(Fig. 16)

Delias aroa [sic] *balimensis* ROEPKE, 1955: 204; D’ABRERA, 1971, 1978: 134.

Types — *Delias aroa balimensis* ROEPKE, *holotype* ♂, INDONESIA: Irian Jaya — Balim (Baliem) River (Balim Valley), labelled “Holotype *Delias aroa balimensis* Rpke, det. W. Roepke/Neth. Ind.-Amer. New Guinea Exp., Baliem Camp [ca. 4.10S 139.01E] 1938, 1700 m 2. XII. L. J. Toxopeus leg./Holotypus Roepke (red label)” and also “*D. aroae balimensis* Tox. ♂ Holotype” (in TOXOPEUS’ handwriting), in Rijksmuseum van Natuurlijke Historie, Leiden; *paratypes* were not designated as such by ROEPKE (1955) but the type series mentioned by ROEPKE should comprise 7 ♂♂ of which we examined: 1 ♂ 17. xii BMNH and 1 ♂ 20. xii RL with label data otherwise similar to those of holotype. Position of “Baliem Camp” was determined from TOXOPEUS (1940: 278) and ARCHBOLD, RAND & BRASS (1942: map 1).

Male — Forewing 24–26 mm (ROEPKE, 1955), apical angle 59°. Upperside: white; forewing with black apical area narrow but curving in anteriorly reaching discal cell; hindwing with black margin much reduced. Underside: forewing with



Figs. 22–31 *Delias* spp. 22: *Delias kenricki* TALBOT ♂, Demaisi AS. 23: *D. kenricki* TALBOT ♀ f. *fuliginosus*, paralectotype BMNH. 24: *D. kenricki* TALBOT ♀ f. *ochraceus*, Angi Lakes BMNH. 25: *D. endela* JORDAN ♂, Eastern Highlands AS. 26: *D. endela* JORDAN ♀, Wau area ANIC, right wings. 27: *D. angiensis* TALBOT ♂, lectotype. 28: *D. angiensis* TALBOT ♀, paralectotype BMNH. 29: *D. yabensis* JOICEY & TALBOT ♂, Paniai AS. 30: *D. yabensis* JOICEY & TALBOT ♀ f.1, paralectotype. 31: *D. yabensis* JOICEY & TALBOT ♀ f. 2 (*brevifascia*), Mt. Kunupi BMNH. Figures are all in approximately natural size. Unless otherwise specified, left wings are shown, upperside on the left, underside on the right.

white area extending to termen; hindwing similar to *aroae*; white median band broad.

Female — Unknown.

Distribution — Balim Valley, east of Mt Wilhelmina, Central Irian Jaya.

Remarks. As mentioned below, *balimensis* and *approximata* from Balim River have the same label data and are probably sympatric. At the moment we cannot decide whether either of these is conspecific with *aroae*.

Delias yabensis JOICEY & TALBOT, 1922, *stat. nov.*

(Figs 2, 29–31)

Delias aroae yabensis JOICEY & TALBOT, 1922: 308–309, figs 8 ♂ dv, 9, 10 ♀ d; TALBOT, 1929: 191–192, pl. 6, fig. 20 lamina dentata; TALBOT, 1932: 84; TALBOT, 1937: pl. 22, fig. 39 androconium.

Delias aroa [sic] *yabensis* JOICEY & TALBOT: ROEPKE, 1955: 204; D'ABRERA, 1971, 1978: 134.

Types — *Delias aroae yabensis* JOICEY & TALBOT, *lectotype* (here designated) ♂, INDONESIA: Irian Jaya — labelled “55. 21. Menoo River, 3500–5000 ft., Weyland Mts. [3.50S 135.50E], Dutch N. Guinea. Nov. & Dec. 1920. C., F., J. Pratt/D. Aroae yabensis J. & T. 1922. Joicey Bequest. Brit. Mus. 1934–120. Type H. T.”, in the British Museum (Natural History); *paralectotypes*: 15 ♂ ♂ 10 ♀ ♀: with label data similar to those of lectotype but Nov. 1920–Jan. 1921, 1 ♀ of which is labelled as “Type A. T.”; Mt Kunupi, Menoo Valley, Weyland Mts 6000 ft 3 ♂ ♂ 3 ♀ ♀ xi. 1920–i. 1921 PRATT (JOICEY); all in BMNH.

Other material examined — INDONESIA: Irian Jaya — Sahueri River 3.25S 139.05E, branch of Idenburg River, 1 ♂ “Lower Mist Camp” 1350 m 30. i. 1939 2 ♂ ♂ “Sigi Camp” 1500 m 17. ii. 1939 (1 ♂ labelled as *D. aroa brumalis* TOXOPEUS (MS) holotype) TOXOPEUS RL, 1 ♂ “Sigi Camp” 1400 m 20. ii. 1939 TOXOPEUS BMNH; Arabu (Araboe) River (east of Paniai-Meer and west of Rouffaer River headwater), 2 ♂ ♂ 16., 22. x. 1939 [BOSCHMA] BMNH, 2 ♂ ♂ 1.–2. xi. 1939 [BOSCHMA] RL; Wissel Lakes, 10 ♂ ♂ 6 ♀ ♀ Paniai [above 1740 m] 30. viii.–14. xi. 1939 [BOSCHMA] RL, 17 ♂ ♂ 1 ♀ Paniai x. 1978 STRAATMAN AS, 1 ♀ (as ♀-f. *brevifascia*) Paniai 11. ix. 1939 BMNH; Weyland Mts, 1 ♀ (as ♀-f. *brevifascia* JOICEY & TALBOT, 1922 holotype) Mt Kunupi xi. 1920 PRATT BMNH.

Male — Forewing 22–24 mm; apical angle 54–56°. Upperside: white; forewing apical black area much less extensive than *aroae*; margin approximately 2 mm from end of cell at M_2 tapering to 1 mm from end of cell at R_{4+5} ; hindwing marginal band narrower than *aroae*. Underside: forewing white area more extensive than any other taxa of *aroae* complex; black area covering one-third of discal cell, totally covering basal part, thence continuing parallel to costa or tapering towards costa for approximately two-thirds of length of cell; black triangular area at end of cell occupying space between discocellulars and costa, distal border roughly perpendicular to costa meeting discocellular between M_1 and M_2 , often irregular; variable white band distal to triangle reaching R_1 , usually continuous with main white area, occasionally reduced to a spot between R_1 and R_3 (found in all related taxa) in which case triangular area not defined; hindwing similar to *aroae*, sometimes with pale yellow suffusion over brown areas.

Female — Similar to male but with slightly broader apical black area upperside

forewing and broader black margin upperside hindwing; dimorphic as in *aroae*: f. 1 (Fig. 30) and f. 2 (Fig. 31), the latter called ♀-f. *brevifascia* by JOICEY & TALBOT (1929).

Distribution — Irian Jaya, central high mountains from Idenburg River in the east to Weyland Mountains in the west. The Idenburg River population in transition between typical *yabensis* and *balimensis* had been singled out by TOXOPEUS (MS) as a separate taxon (*brumalis*, a *nomen nudum*), but ROEPKE (1955) considered the differences from *yabensis* insignificant and accordingly placed it in this taxon.

Remarks. *D. yabensis* is allopatric with *balimensis* and *angiensis* but apparently sympatric with *approximata* in many localities, although ROEPKE (1955) states that *yabensis* occurs at lower altitudes than *approximata*.

Delias angiensis TALBOT, 1928, **stat. nov.**

(Figs 27, 28)

Delias aroae angiensis TALBOT, 1928: 43; 1929: 192; 1932: 84; 1937: pl. 10, fig. 43 valva.

Delias aroa [sic] *angiensis* TALBOT: D'ABRERA 1971, 1978: 134.

Types — *Delias aroae angiensis* TALBOT, *lectotype* (here designated) ♂, INDONESIA: Irian Jaya — labelled “ANGI LAKES ARFAK MTS. 6000 FT. [1800 m] NORTH N GUINEA, MARCH 1914, A, C, & F, PRATT/*Delias aroae angiensis* Talb. ♂ H. T./Joicey Bequest Brit. Mus. 1934-120/Type H. T.”, in the British Museum (Natural History); *paralectotypes* 13♂♂ 1♀ with the same label data but ♂♂ labelled as “Jan.-Feb. 1914”, and ♀ as “♀ A. T./Type A. T.” in BMNH.

Other material examined — INDONESIA: Irian Jaya — Warmassin 1♂ 1800 m iii. 1910 C. & F. PRATT (JOICEY) BMNH; Arfak Mountains, 1♂ Mt Kobarai 2600 m ii. 1909 C. PRATT (KENRICK) BMNH, 2♂♂ without date AO, 4♂♂ without date 3♂♂ 11, 16. iii. 1976, 24. vii. 1977 T. NISHIZAWA AS.

Male — Forewing 23–25 mm; apical angle 53–54°. Forewing and upperside indistinguishable from certain *aroae* type 2a forms. Hindwing underside with median crenulate band terminating in CuA₂-1A+2A, without reaching dorsum, rather like ♀-f. 2 of *aroae* and *yabensis*.

Female — Forewing 24 mm. Forewing similar to *aroae* ♀ f. 1; hindwing with median crenulate band narrower, largely as in ♂. ♀ f. 2 may exist but so far unknown.

Distribution — Irian Jaya, Vogelkop: Angi (Anggi) Lakes, Arfak Mts 1900–2600 m.

Delias pheres JORDAN, 1911

(Figs 6, 13)

Delias aroae pheres JORDAN, 1911: 588.

Delias pheres pheres JORDAN: TALBOT, 1929: 188, pl. 2, fig. 36 uncus; 1930: pl. 42, fig. 1, ♂v; 1932: 83; 1937: pl. 10, fig. 42 valva; ROEPKE, 1955: 203; D'ABRERA, 1971, 1978: 134 (partim).

Types — *Delias aroae pheres* JORDAN, *lectotype* (here designated) ♂, INDONESIA: Irian Jaya — labelled: “Mt. Goliath, 5–7000 ft. [1500–2100 m], Centr. Dutch N. Guinea, about 139° long., Januar 1911 (A. S. Meek)/*Delias aroae pheres* Type. 1912. Jord.

Nov. Zool. 18. p. 588.", in the British Museum (Natural History); *paralectotypes* 14♂♂ 12♀♀ (of which 3♂♂ 1♀ were examined) similarly labelled but February as well as January, in BMNH.

Other material examined — INDONESIA: Irian Jaya — Mt Goliath 1♂ (*FRUHSTRFER*), Snow Mountains 7. i. 99 [= 1911?] 1♂, no data 1♂ 1♀ (*JOICEY*), all BMNH.

Male — Holotype forewing 27 mm, apical angle 51°. Generally larger than most other taxa of the complex. Upperside: white; very much like *aroae* type 1a and *approximata*, but black apical area of forewing broader than any *aroae* specimens examined. Underside: forewing black area much more extensive than *aroae* 1a; discal cell largely black, white area not meeting anterior margin of cell; hindwing yellow markings well developed, almost obliterating median white band.

Female — Forewing 26 mm. Very similar to *aroae* ♀ f. 1 but darker as in male; sometimes with small yellowish subapical spots on upperside forewing.

Distribution — According to JORDAN the type locality of *phaeres* is upstream of the Eilanden River on the slope of Mt Goliath and at about 139°E. The Eilanden River forks extensively, the westernmost branches being the Balim River, and the middle branch stemming from Mt Goliath (140°45'E). The 139°E meridian passes near the Balim Camp of TOXOPEUS. Hence the type locality is either east of Mt Wilhelmina or the southern slope of Mt Goliath. These localities are from 70 to 140 km apart.

Delias approximata JOICEY & TALBOT, 1922, **stat. nov.**

(Figs 3, 14, 15)

Delias phaeres [sic] *approximata* JOICEY & TALBOT, 1922: 309; 1924: pl. 8, figs 5♂ dv, 6, 7, ♀ d.

Delias phaeres approximata JOICEY & TALBOT: TALBOT, 1929: 188–189, pl. 2, fig. 37 uncus, pl. 6, fig. 21 lamina dentata; 1932: 83; 1937: pl. 22, fig. 38 androconium; D'ABRERA, 1971, 1978: 133, figs ♂ v ♀ d.

Types — *Delias phaeres approximata* JOICEY & TALBOT, 1922 *lectotype* (here designated) ♂, INDONESIA: Irian Jaya — labelled "55. 21 Menoo River, 3500–5000 ft. [1000–1500 m], Weyland Mts., Dutch N. Guinea. Nov. & Dec. 1920. C., F., & J. Pratt/D. phaeres approximata J. & T. 1922/Joicey Bequest. Brit. Mus. 1934–120/Type H. T." in the British Museum (Natural History); *paralectotypes*: 14♂♂ 1♀ with label data similar to those of lectotype but also "1. Dec. 20–Jan. 21." and ♀ labelled as allotype; Weyland Mts, Mt Kunupi, Menoo Valley, 1800 m xi.–xii. 1920 PRATT (*JOICEY*) 2♂♂ 12♀♀ BMNH 1♀ RL.

Other material examined — INDONESIA: Irian Jaya — Balim (Baliem) River, 1♂ "Baliem Camp" 1700 m 20. xi. 1938 RL, "Ibele Camp" 2250 m 8♂♂ 9. xi.–3. xii. 1938 RL 2♂♂ 1♀ 2. xii. 1938 BMNH TOXOPEUS, 6♂♂ 3♀♀ "Moss Forest Camp" 2600 m 23. viii.–5. xi. 1938 TOXOPEUS (1♀ 21. x. labelled as f. *separata* TOXOPEUS paratype) RL, 1♀ Lake Habbema 2650 m 23. viii. 1938 "open boschplekt, N. V." TOXOPEUS (labelled as f. *designata* ROEPKE holotype) RL; Arabu (Araboe) River, 3♂♂ 1♀ "Araboe Bivak" [1800 m] 13. x.–5. xi. 1939 [BOSCHMA] RL; Wissel Lakes, 2♂♂ Paniai [above 1740 m] x. 1978 STRAATMAN AS; Weyland Mts, 1♀ Menoo Valley 2♀♀

Kunupi River as in holotype and paralectotypes but labelled as ♀-f. *rectimargo* JOICEY & TALBOT (1 ♀ Kunupi River labelled as holotype *rectimargo*) BMNH.

Male — Forewing 25 mm; apical angle 52–53°. Upperside: similar to *pheres* and *aroae* type 1a; forewing occasionally with 3 faint subapical white spots. Underside: forewing with white area almost meeting anterior margin of cell but generally not as extensive as in *aroae*; in a specimen from Paniai there is a heavy yellow suffusion over the brown ground colour, particularly around the margins of the yellow spots, a feature also present in some specimens of *yabensis* from the same locality.

Female — Forewing 23–27 mm. Polymorphic: f. 1 (Fig. 14) similar to *aroae* ♀ f. 1; f. 2 (Fig. 15, designated ♀-form *rectimargo* by JOICEY & TALBOT (1922) similar to *aroae* ♀ f. 2 and *yabensis* ♀ f. 2 (*brevifascia*); f. 3 as f. 1 but forewing underside white replaced by yellow except for the area between dorsum and mid space $CuA_2-1A+2A$; upperside white area with slightly yellowish tinge along border with black area; otherwise similar to f. 1. All forms have 2 (rarely 3) subapical yellowish spots upperside forewing; in some specimens of f. 1 underside forewing with black apical area separated from cell and triangular black marking by a white band reaching R_1 as in *yabensis*.

Distribution — Central Irian Jaya, from Weyland Mountains in the west to Balim River in the east along Snow Mountains.

Remarks. The two taxa *yabensis* and *approximata* are sympatric in Weyland Mountains, Wissel Lakes and Arabu River, ranging 1000–1800 m. However, as ROEPKE (1955) pointed out, *approximata* and *yabensis* (and probably *pheres* and *balimensis*) are largely segregated, *yabensis* occurring at 1350–1500 m near the Sahuweri River (a tributary of the Idenburg River north of the great divide) whereas *approximata* occurs at 2250–2650 m near the Balim River on the northern slope of Mt. Wilhelmina (with the exception of 1 ♂ coming from “Baliem Camp” (1700 m) which is the type locality of *balimensis*). “*D. balimensis*” or its ally is unknown from Mt. Goliath (1500–2100 m), the type locality of *pheres*. Probably *approximata* and *pheres* overlap morphologically and should be regarded as conspecific but distinct from *balimensis* and *yabensis*.

Delias subapicalis sp. nov.

(Fig. 10)

Types — *Holotype* ♂, PAPUA NEW GUINEA: labelled “NEW GUINEA [Western Highlands Province] Nondugl (Central Highlands) 5500 ft. [1700 m] November 24 1950 Collected by Wm. Brandt E. J. L. Hallstrom/Type No. 3311” in Australian National Insect Collection; *paratypes* 12 ♂ ♂: Chimbu Province — Wahgi River, 1 ♂ Kundiawa v. 1982 1 ♂ Denglagu-Gunggugme (Denglagu Catholic Mission) vi. 1981 IFTA/AS, 1 ♂ Kerowagi iii. 1969 (EBNER) BMNH; Western Highlands Province — Wahgi River, 3 ♂ ♂ Nondugl as holotype ANIC, 1 ♂ Behind Nondugl 1600 m 27. iv. 1950 1 ♂ 1600–2450 m 17. vi.–13. v. 1950 both E. T. GILLIARD (L. J. SANFORD) BMNH — Mt Hagen, 1 ♂ 2300–3700 m 21. vi.–1. viii. 1950 E. T. GILLIARD (L. J. SANFORD) BMNH — Lai River, 2 ♂ ♂ Walya 2500 m 14. x. 1974 P. SAWYER AO, 1 ♂ Wapenamanda 3. vii. 1970 D. JEFFERS AS.

Male — Holotype forewing 26 mm; apical angle 54°. Upperside: white; forewing black apical area narrow, 4 mm from discal-cell end, meeting costa two-thirds of its length from wing-base; row of 3 distinct white subapical spots; border of black apical area sharp and more angular at M_1 than in other taxa; hindwing black margin 1–2 mm, broken into discrete spots towards tornus. Underside: forewing discal cell predominantly black; black area totally covering its basal half, thence tapering distad and joining apical black area near anterior border of cell; hindwing white median band narrower than in *aroae*, yellow markings strongly developed. Other males similar, rarely small (24 mm), usually larger than *aroae* (26–27 mm), apical angle 53–56°.

Female — Unknown.

Distribution — Papua New Guinea, Central Highlands from Wapenamanda to Kainantu, headwaters of Lai, Wahgi and Ramu Rivers, and also Mt Kaindi near Wau and near Tapini, thus extending to south of the great divide. T. FENNER and M. PARSONS informed us that the collections of the Papua New Guinea Government at Konedobu and IFTA contained specimens from Mandandurugl and Gembogl (Chimbu), Onamuga near Kainantu (Eastern Highlands), Mt. Kaindi (Morobe) and Unialavava (Unilavava, Unilava; Goilala) above Tapini (Loloipa River, Central).

Remarks. This taxon may be distinguished from others of the group by a combination of characters, notably its larger size, white ground colour on either surface, narrow apical black area with an angular border and rather conspicuous subapical spots on the forewing above, and the largely dark discal cell on the forewing beneath. It is relatively distinct, and in view of these rather constant differences together with its higher altitude preferences and sympatry with *aroae* at many localities, and given the necessary separation of *approximata* and *yabensis*, it is logical, to maintain a consistent classification, to afford *subapicalis* specific rank.

Delias hyperapproximata Species-Complex

Included taxa: *D. hyperapproximata* ROTHSCILD, 1925

D. angabungana TALBOT, 1928

D. endela JORDAN, 1930

The three taxa included in this species-complex are allopatric and sufficiently close for their status relative to each other to be uncertain, but differences of wing shape and pattern clearly distinguish them from taxa of the *aroae* complex. All three occur in Papua New Guinea and were treated by TALBOT (1928–1937) and ROEPKE (1955) as subspecies of *D. pheres* from Irian Jaya, but since *angabungana* and *endela* are sympatric with *aroae*, itself closely allied to *pheres*, such a connection is untenable.

Delias hyperapproximata ROTHSCILD, 1925, *stat. nov.*

(Figs 4, 5, 11)

Delias pheres hyperapproximata ROTHSCILD, 1925: 675; TALBOT, 1929: 190; 1932: 84; D'ABRERA, 1971, 1978: 133 (partim).

Types — *Delias pheres hyperapproximata* ROTHSCILD, *holotype* ♂, PAPUA NEW

GUINEA: Morobe Province — labelled “Rawlinson Mts. Inland Huon Gulf (Keysser)/D. pheres hyperapproximata Type Rothschild/Type” in the British Museum (Natural History); *paratypes* 7 ♂♂ 4 ♀♀ of which were examined: 1 ♂ 1 ♀ with label data similar to those of holotype (♀ also labelled “Type P. T.”) BMNH.

Other material examined — PAPUA NEW GUINEA: Madang Province — Finisterre Range, 2 ♂♂ Matoko 5.41S 146.33E 1500 m 29. viii.–24. ix. 1958 1 ♂ Tukupuli 5.45S 146.15E W. BRANDT ANIC; Morobe Province — Cromwell Area, 3 ♂♂ Komba “78.28” 6.10S 147.20E BMNH — “Indagen”, 1 ♂ 17. viii. 1974 P. SAWYER AO.

Male — Forewing 24–25 mm; apical angle 47–51°, both wings with apex rather acute. Upperside: white; forewing with black apical area broad (2.5 mm) at tornus, and curving in sharply for 1.5 mm to meet caudal end of discocellular, thence continuing along distal margin of cell, producing a stepped effect in border of black area; hindwing black border 3–4 mm at apex, tapering and breaking into triangular patches towards tornus. Underside: basal half of forewing strongly yellow below discal cell, yellow extending halfway into outer discal area, cell otherwise black; hindwing median crenulate band narrow.

Female — Forewing 28 mm. Upperside: black area on both wings rather broader than in male. Underside: forewing yellow area replaced by a more extensive yellow-tinged creamy area; hindwing median white crenulate band much wider than in male, almost without yellow spots, and terminating before dorsum as in *angiensis* ♂.

Distribution — Finisterre Range and other montane areas of Huon Peninsula.

Delias angabungana TALBOT, 1928, **stat. nov.**

(Figs 7, 12)

Delias pheres angabungana TALBOT, 1928: 42; 1929: 190; 1932: 84.

Delias pheres hyperapproximata ROTHSCILD: D'ABRERA, 1971, 1978: 133 (partim).

Types — *Delias pheres angabungana* TALBOT, *holotype* ♂, PAPUA NEW GUINEA: Central Province — labelled “Angabungana R., afl. of St. Joseph R. Brit. N. Guinea, 6000 ft. [1800 m], upwards. Nov. 04–Febr. 05 (A. S. Meek)/TYPE (H. T.)” in the British Museum (Natural History).

Other material examined — PAPUA NEW GUINEA: Central Province — Tapini area, 10 ♂♂ Loloipa River Bome 1900 m 25. ii.–2. v. 1958 W. W. BRANDT ANIC.

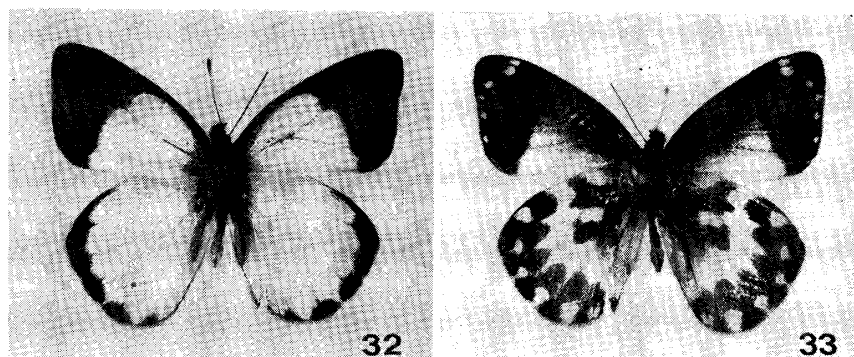
Male — Forewing 24–26 mm; apical angle less acute than *hyperapproximata* (approx. 52–53°). Generally larger than the latter. Upperside: ground colour slightly creamier white than in *hyperapproximata*; black border sometimes not reaching the cell end and smoothly decurved at its boundary on forewing, much broader on hindwing, sometimes continuous and not tapering or breaking up into discrete patches towards tornus. Underside: similar to *hyperapproximata*; forewing with yellow area more extensive than in *hyperapproximata*, occupying basal three-quarters of wing below discal cell and extending further into the distal area of cell.

Female — Unknown.

Distribution — Tapini area of Papua New Guinea; not recorded elsewhere.

Remarks. The Angabunga River passes below Tapini; hence the type locality of *angabungana* may be near Tapini. This taxon is sympatric with *aroae*. However, collecting around Tapini (about 1200 m) in June, one of us (AS) did not encounter this taxon. It may be restricted to higher altitudes or earlier months of the year. The holotype (Fig. 7) is an intermediate between *hyperapproximata* (Figs. 4, 5) and the Bome population (Fig. 12).

This taxon is in some respects intermediate between *hyperapproximata* and *endela*. This however may not reflect relative phylogenetic status, as the rather extensive geographical range of *endela* occurs roughly between the ranges of *angabungana* and *hyperapproximata*.



Figs 32–33 *Delias endela* JORDAN ♂, Poketamanda, Western Highlands PS.
32: Upperside. 33: Underside.

Delias endela JORDAN, 1930, **stat. nov.**

(Figs 8, 25, 26, 32, 33)

Delias pheres endela JORDAN, 1930: 279; TALBOT, 1932: 84; 1937: 586–587.

Delias pheres hyperapproximata ROTHCHILD: D'ABRERA, 1971, 1978: 133 (partim).

Type — *Delias pheres endela* JORDAN, *lectotype* (here designated) ♂, PAPUA NEW GUINEA: Morobe Province — labelled “Edie Creek, Westside of Herzog Mts, 6100 ft. [1850 m] early 1928. (A. F. Eichhorn)/*Delias pheres endela* Type. Jord. Nov. Zool. 1930./ Type” in the British Museum (Natural History); *paralectotypes* 3♂♂ 1♀ with data as for holotype, not examined.

Other material examined — PAPUA NEW GUINEA: Morobe Province — Wau area, 7♂♂ Wau iii. 1973 H. OHLMUS AS, Kodama Range Mt. Kaindi 5♂♂ 1400 m 20. xi–10. xii. 1951 1♀ W. W. BRANDT ANIC, 1♂ 13. iii. 1973 T. W. DAVIES BMNH, 1♂ 2150 m i. 1974 A. ORR AO, 1♂ Nami Creek 1700 m 19. x. 1968 P. COLMAN AS, 4♂♂ Kunai Creek 1200 m xii. 1973 A. ORR AO, 1♂ 1500 m 11. vii. 1982 IFTA/AS — Menyamy area, 1♂ Niniwe Mission 1600 m IFTA/AS; Eastern Highlands Province — Lufa, 2♂♂ Mt Michael 2150 m 11. vi. 1973 A. SIBATANI AS; Chimbu Province — 1♂ Kerowagi iii. 1969 (J. A. EBNER) BMNH; 2♂♂ v., ix. 1982 IFTA/AS; Western Highlands Province — Wahgi River, 11♂♂ Nondugl 1700 m 1.–27. xi. 1950 W. W. BRANDT ANIC, 1♂ Behind Nondugl 1600–2450 m 17. iv.–13. v. 1950 E. T. GILLIARD

(L. J. SANFORD) BMNH — Lai River (Wapenamanda/Wabag area), 1♂ Hagen Range Pap Creek 20. ix. 1973, 1♂ Timina River Elekanda 2100 m 28. vi. 1969, 1♂ Poketamanda 2600 m 20. ix. 1969, P. SAWYER PS.

Male — Forewing 22–26.5 mm; apical angle 51–55°. Upperside: similar to *angabungana* but white area less creamy than in the latter; black area of forewing generally slightly wider, and marginal black band of hindwing slightly narrower than in *angabungana*. Underside: forewing black except for a narrow white area extending along dorsum from near the base to three-quarters of the distance to tornus; hindwing similar to *hyperapproximata*. Generally, Lufa and Nondugl specimens are smaller than those from Wau. Some males from Wau and Lai River show varying degrees of reduction of black scale-cover on underside forewing. The light area thus generated is pale creamy white. An extreme case from Wabag area (Figs 32, 33) resembles *D. hyperapproximata* underside but is not yellow. This particular specimen also has a narrow black margin on hindwing upperside as in *hyperapproximata*, but this variation cannot be clinal, in view of the extreme allopatry of *hyperapproximata* and this particular form.

Female — Forewing 25 mm; apical angle 58°. Upperside: white; similar to *hyperapproximata*; black area of forewing broader than in male, margin angular as in *aroae*. Underside: forewing with basal two-thirds yellowish white; in ANIC ♀, basal two-thirds of discal cell black; hindwing median band broad, not crenulate, and with strong yellow patches, becoming diffuse towards dorsum, and united with submarginal yellow spots, thus quite unlike the tapering band in *hyperapproximata*, whereas according to JORDAN (1930) paralectotype ♀ seems to have a narrow median band.

Distribution — Papua New Guinea highlands from Wabag area to near the eastern end of the Owen Stanley Range. P. SAWYER informed us that the species also occurs at Anji Creek, Hagen Range (Western Highlands). According to M. PARSONS, the Papua New Guinea Government Collection at Konedobu included specimens from Frigano (Eastern Highlands) and Mt Suckling (border of Central, Northern and Milne Bay Provinces), and the IFTA collection contained specimens from Kundiawa and Mandandurugl near Kerowagi (Chimbu), Sambio near Mumeng (Morobe) and Komako near Kaintiba (Gulf).

Remarks. The name “Herzog Mts” is now applied to the montane area located immediately south-west of Lae and including Mt Shungol. However, Edie Creek is situated west of Wau, at the foot of Mt Kaindi, and is the site of a gold mine (2000 m) discovered in 1926, two years before the capture of the lectotype specimen. Therefore we assume that the type locality of *endela* is near Wau.

The relation of this taxon to *hyperapproximata* on the one hand and to *angabungana* on the other should be analysed by examining specimens from intervening areas. The females of *endela* and *hyperapproximata* are unlike their respective males but rather similar to each other, both with forewing underside pale yellow.

Delias flavissima sp. nov.

(Fig. 9)

Types — *Holotype* ♂, PAPUA NEW GUINEA: Western Highland Province — labelled "PAPUA NEW GUINEA Wapenamanda 26. vii. 1974 7000' [2100 m] Don Jeffers/Type No. 3310" ex coll. Keiichi OMOTO, Tokyo, now in the Australian National Insect Collection; *paratypes* 5 ♂♂, Western Highland Province — Lai River, Walya 2 ♂♂ 2500 m P. SAWYER AO, 2 ♂♂ Pap Creek 3000 m 19. vi. 1973 A. SIBATANI AS and BMNH, Wapenamanda 1 ♂ 23. vi. 1970 D. JEFFERS AS.

Male — Forewing 24–27.5 mm; apical angle 55–57°, larger than most other taxa of the group; hindwing relatively large in proportion to forewing: ratio of length hw/fw=0.87 compared with 0.79–0.83 for other members of the group. Upperside: lemon yellow; forewing black apical area extending into discal cell; row of 4–5 subapical yellow spots; hindwing with narrow black marginal band of uniform width but broken into spots towards tornus. Underside: forewing basally yellow with inner two-thirds of discal cell black; hindwing with narrow median crenulate band.

Female — Unknown.

Distribution — Papua New Guinea Western Highlands, 2000–3000 m, Lai River; not found east of the Hagen Range.

Remarks. This taxon is sufficiently distinct from the other members of the *aroae* group to be considered as an independent species; it is immediately distinguished from all other species of the group by the pure lemon yellow ground colour on the upperside of both wings. It is sympatric with *D. subapicalis* and *endela*.

Delias kenricki TALBOT, 1937, stat. rev.

(Figs 22–24)

Delias fuliginosus KENRICK, 1909: 176, pl. 6, figs 1 ♂ dv, 1 ♀ dv, preoccupied by *Papilio fuliginosus* GMELIN 1790 (= *Delias derimene* STOLL, 1782); TALBOT, 1929: 193–195, pl. 2, fig. 39 uncus; 1930: pl. 42, figs 2, 3, ♀ dv; 1932: 84; 1937: pl. 10, fig. 44 valva, pl. 22, fig. 40 androconium.

Delias fuliginosus [sic], ab. *ochraceus* JOICEY & NOAKES, 1915: 59, pl. 4.

Delias kenricki TALBOT, 1937: 587.

Delias pheres kenricki ROEPKE, 1955: 203; D'ABRERA, 1971, 1978: 133, figs ♂ v, ♀ d.

Types — *Delias fuliginosus* KENRICK (= *Delias kenricki* TALBOT) *lectotype* (here designated) ♂, INDONESIA: Irian Jaya — labelled "Momi, 4000 feet [1200 m], Arfak Mountains, North New Guinea, Nov. & Dec. 1908 Coll. C. Pratt./Joicey Bequest, Brit. Mus. 1934–120/Type H. T." in the British Museum (Natural History); *paralectotypes* examined: 1 ♂ 1 ♀ with similar label data, ♀ also labelled "Type A. T."

Other material examined — INDONESIA: Irian Jaya — Arfak Mountains, 13 ♂♂ 6 ♀♀ Angi Lakes i.–ii. 1914 (1 ♀ labelled "♀ f. *ochraceus* JOICEY & NOAKES holotype") 2 ♂♂ Warmasin 1830 m ii. 1909/iii. 1910 PRATT 1 ♂ 1 ♀ x. 1970 S. SAKAI 1 ♂ Mt. Koberai 2450 m BMNH, 2 ♂♂ AO, 1 ♂ 24. vii. 1977 5 ♂♂ Demaisi 2–10. iii. 1976 T. NISHIZAWA 2 ♂♂ "Manokwari" R. STRAATMAN, AS.

Male — Forewing 25 mm; apical angle 46–50°, acute. Upperside: sooty brown with intervenous yellow suffusion; hindwing with strongly scalloped margin. Underside: forewing entirely black except for usual subapical and marginal yellow spots and post-median spot below subcosta; hindwing with median band very narrow and strongly crenulate.

Female — Ground colour similar to male; wings more rounded. Dimorphic: form *fuliginosus* (Fig. 23) — upperside, yellow median suffusion on both wings and a row of subapical and marginal spots on forewing; underside, forewing with broad median band, white on dorsum and becoming dark grey, then indistinct anteriorly, due to heavy suffusion of black scales — form *ochraceus* (Fig. 24) — upperside with median suffusion lighter than in *fuliginosus*; underside, forewing with wide white median band divided anteriorly by a black band at end of discal cell.

Distribution — Irian Jaya, confined to Arfak Mountains of Vogelkop.

Remarks. This is one of the most divergent members of the group. The scalloped border of the hindwing is reminiscent of the *D. cuningputi* group, but the submarginal spots of the underside of the hindwing, and the genitalia (figured by TALBOT 1928–1937) more closely resemble *aroae* than *cuningputi*. Until ROEPKE combined this taxon with *pheres* without giving any reason, it had always been treated as an independent species.

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摘 要

ニューギニア島カザリシロチョウ属 *aroae-cuningputi* 複合の分類法の改訂

1. *Delias aroae* 群 (Albert G. Orr・柴谷篤弘)

ニューギニア本島高地に産するカザリシロチョウ属の蝶はきわめて変化に富み、その分類学上の位置

が明確でない多くの種・亜種水準の分類単位（タクソン）が存在している。従って新しい種や亜種を命名するためには、まず既存のすべての種・亜種名に該当する実体を明らかにし、その分類法を定める必要が生ずる。これまでに用いられてきた種々の標徴の分類学的価値を検討したのち、“*Delias aroae-cuningputi* 複合”を定義したうえ、これに属する12分類単位のみと♀の検索表を作成した。そのうえで、“*D. aroae* 群”を定義した。可能なかぎりタイプ標本を図示した。*D. aroae* 群は四部分に区分され、そのうちには二つの種複合体があり、それぞれの内部では、大部分の分類単位は、その分類学的位置が明確に定義できない。そのため形式上これらをすべて二名式学名で呼ぶことにして、それぞれの実体を強調することにした。さらに *D. subapicalis* と *D. flavissima* の2新種を記載した。

解 説

この論文で取扱った諸型は、従来は *D. aroae* と *D. pheres* の2種に分属せしめられてきた。近年パプアニューギニアから多くの個体がえられたため、この地方における実相がかなり明らかになった。これらについては、まずその表面外縁の黒色部が、とくに後翅で幅広く、前翅裏面中央部が白色を呈しないものと、後翅表面の黒色ふちどりが幅狭く、前翅裏面中央部が白いものに区別される。その差は常に安定しており、また両者は多くは同所的 (sympatric) であるため、これらを種水準で区別することには問題はない。前者が *pheres*、後者が *aroae* (*aroa* と誤記されることが多い) と呼ばれてきた。*D. aroae* のタイプ産地は現在のタピニの南方に相当するが、パプアニューギニア全体にわたって広く分布している普通種である。

これに対して *pheres* を代表するものとしては、ワウを中心に中央産地に分布する *endela* がよく知られている。これは前翅裏面が黒いので見わけがつく。これとよく似ているが前翅裏面が黄色を呈するものが、*endela* の産地より北東、ラエの北にあるフィニステル山脈と、ワウの南側、タピニ地方に、ちょうど *endela* によって分断された形で産する。北東のものが *hyperapproximata* で、南のものが *angabungana* である。両方とも比較的まれで、図示されることもなかったため、よく知られていない。しかもこの両者の差もはっきりしているのだから、*endela*, *hyperapproximata*, *angabungana* の相互関係は、1種の3亜種か、1種が他の1種の産地を広く分断しているのか、異所性の3独立種かをいまだちにきめることができない。このような場合の処置として、この論文では、これら3者の独自性を強調するためもある、すべて二名式であらわすことにして、その種としての相互関係は、いっそう資料がえられてからきめるべきだ、という方針をとることにした。

しかし *pheres* 自身のほうはどうなっているかというと、これは西イリアン中央山地の東部、パプアニューギニアとの国境から 160 km ほどのゴリアト山から記載されていて、*aroae* よりもやや大形、前翅表面黒縁がよく発達し、前翅裏面中室がほとんど黒い点で区別される。また前翅頂もやや鋭角をなす。これはどうみても、*endela*, *hyperapproximata*, *angabungana* などよりは *aroae* に近い。ゴリアト山からさらに西へ 100 km ほどのところから、ウィルヘルミナ山をへてウィッセル諸湖のあたりまで、約 300 km にわたり、従来 *pheres* の亜種とされてきた *approximata* が産する。これは *pheres* によく似ているが、やや小形で、前翅の黒色部はそれほど強く発達していない。しかし *pheres* と *approximata* はおそらくはよく連続するもので、同一種の地方型である可能性が大きい。

しかるに、*approximata* の産地では、これと重って、*yabensis* が知られている。これは前翅の黒色縁がさらに幅狭く、その境界は、前翅中室端よりはるかに外縁よりを走る。この2型は、通常よく区別され、同所性ということもあるが、*approximata* と *yabensis* を異種として区別することには、従来異論がなかった。しかし上述のように *pheres* と、*endela* などのパプアニューギニアの3型が、互いに別種であるということになると、*pheres/approximata* と、*yabensis* のどちらが、パプアニューギニアの *aroae* と同一種になるのか、という形で問題が提起しなおされている。従来は *pheres* がこのグループから除外されていたので、*yabensis* が半自動的に *aroae* と同じ種にされたが、われわれはまず、そうはかた

んにきめてしまえない、というところから出発した。そしてしらべてみると、パプアニューギニアの *aroae* には変異が多くて、一見 *yabensis* に近いものから *approximata* に近いものまで、いろいろあるが、これを画然と2種にわけるとは、どうしてもできない。とすると、東では1種であるものが、西へ連続していくうちに2種に分岐してしまうのだろうか、という疑問が生ずる。

この問いにこたえるには、中間地帯のものをしらべればいい。パプアニューギニアでは、国境に近いテレフォミンまでは、*aroae* が分布しているが、国境の西からはデータがなく、ゴリアト山のものは知られていない。そして国境から西へ200 km のバリム川（ウィルヘルミナ山の東）から、戦前の米蘭合同探検隊に参加したトクソペウスの採集整理した材料にもとづいて、戦後になってルプケが *D. aroae* の亜種として記載した *balimensis* が、上記の *pheres* とともに、中間地帯に産するものを代表する。

このうち *balimensis* は、たしかに *yabensis* や *pheres* よりも *aroae* に近いが、*pheres* は逆に *approximata* よりも *aroae* から遠い。トクソペウスによれば、*balimensis* はバリム川で1350–1700 m に、*approximata* は2400 m を中心に1700–2800 m にかけて、たがいに棲みわけているという。このようなことは、パプアニューギニアでは観察されていない。バリム川から北へ大分水嶺をこえた、北流するイデンプルフ川の上流から知られているものは、ルプケによって *yabensis* に属せしめられている。私どももこの処置には賛成である。

ここで *pheres/approximata*, *yabensis*, *aroae* 3者の相互関係をどうするかという問題が生ずる。間に *balimensis* をおいて、いろいろに種の境界を推測しても、実像をゆがめるだけであるし、材料の不備もあるために、われわれはここに一切の判断をさけて、当分は、関連する諸型をすべて二名式で表現することにした。これはわれわれが、これら各型を独立種とみとめることを意味するのではなく、むしろ三名式の表現が、実在を歪曲することを避けるための処置なのである。これによって諸家の注意を、*aroae* 群にふくまれるすべての種群分類単位（種+亜種）にむけて、それらの間の関係を早期に明らかにする契機をつくりだすことができれば幸である。

さらに、*aroae* を中心とする複合には、西イリアン西北アルファク山塊に産する *angiensis* がある。これは従来 *aroae* の亜種とされてきた。後翅裏面中央白帯が後縁に達しないという明確な特徴をもつ。ここでは独立種としてとりあつかう。さらにパプアニューギニア中央西部高地には、大型で前翅亜翅頂斑の明瞭な新種 *subapicalis* を認める。これは *aroae* と部分的に同所性で明らかな別種であるが、*pheres* の代替型とは考えられない。

この最後のものと同所性の顕著な新種 *flavissima* は表面が鮮黄色で横長の翅形も特有なものである。マウント・ハーゲンからハーゲン山脈を西にこしたライ川流域の高地に限って産するものである。これは、*subapicalis* とともに、雌が未知である。

さらにはじめは独立種とされながら、ルプケ以来 *pheres* の亜種とされるようになった、アルファク山塊に産する *kenricki* がある。これは雄の表面がすすけた黄灰褐色で、白色部をもたない点でただちに判別できる立派な独立の普通種である。

和名としては *aroae* をアロアカザリシロチョウ、*endela* をエンデカザリシロチョウ、*pheres* をフェレスカザリシロチョウ、*subapicalis* をサブピカザリシロチョウ、*yabensis* をヤベンカザリシロチョウ、*approximata* をアプロカザリシロチョウ等とすることを提案する。以下同様にアングカザリシロチョウ、ケンリカザリシロチョウ、バリメカザリシロチョウ、ヒペラカザリシロチョウ、アングカザリシロチョウ、フラビカザリシロチョウなどの和名が提案できる。